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EXPLORATIVE R&D COLLABORATION: SEARCHING FOR EFFECTIVE AND EFFICIENT GOVERNANCE MECHANISMS

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Searching for Effective and Efficient Governance Mechanisms

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ABSTRACT

Explorative R&D collaboration is an important alternative for the internal development of new technologies. The high failure rate of this type of inter-organizational collaboration, however, indicates that governing explorative R&D collaboration is not a straightforward task. Moreover, we argue that different theoretical perspectives have formulated contradictory advice of how to govern explorative R&D collaboration. Given high risks of opportunistic behavior and high coordination costs within explorative R&D collaboration, Transaction Cost Economics and Organization Theory emphasize the need for formal governance mechanisms. The innovation literature, however, stresses that formal governance mechanisms prohibit the carrying out of explorative activities which are necessary to develop new technologies. We also suggest two alternatives to address these paradoxical requirements. In specific, we argue that effective and efficient governance of explorative R&D collaboration can be achieved by 1) collecting second-hand information about potential partners, allowing for the substitution of formal governance by relational governance, and 2) combining formal and relational governance mechanisms. Based on these theoretical findings, we emphasize the importance of longitudinal, multi-level research to study the characteristics and dynamics of different governance mechanisms within inter-organizational collaboration.

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INTRODUCTION

Historically, market alliances have generally been the most widespread form of inter-organizational collaboration (Harrigan, 1986). However, since the late 1980s most of the initiated inter-organizational collaborations have a substantial technological content and even a specific R&D focus as inter-organizational collaboration has been identified as a useful tool to develop new technologies (Doz & Hamel, 1997; Doz & Williamson, 2002; Hagedoorn, 2002; Wheelwright & Clark, 1992). In specific, inter-organizational collaboration is considered to be an alternative for the internal development of new technologies because it can both reduce the economic risks associated with the development of new technologies and increase the pool of diverse resources, needed to introduce new technologies successfully.

Despite these potential advantages, inter-organizational collaboration may encounter two particular problems, threatening successful collaboration within such innovative settings. First, according to Transaction Cost Theory (TCE) (e.g. Pisano, 1990; Poppo & Zenger, 2002; Williamson, 1991), inter-organizational collaboration used to develop new technologies faces substantial risks of opportunistic behavior. Second, researchers, looking from an Organization Theory (OT) perspective (e.g. Dekker, 2003; Gulati & Singh, 1998), argue that the completion of technological complex tasks will cause coordination problems between the partners. According to both TCE en OT, these problems can be dealt with by implementing formal governance mechanisms such as contractual obligations and formal organizational mechanisms (Dekker, 2003; Poppo & Zenger, 2002; Williamson, 1991). After all, formally governing the inter-organizational relationship triggers processes of formal control and formal

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coordination, minimizing the perceived risk of opportunistic behavior and costs of coordination.

While formal governance mechanisms are being advised from a TCE and OT perspective, this advice can be questioned when considering the innovation literature. Several innovation researchers (e.g. Ahuja & Lampert, 2001; Burgelman, 1983; Lant & Mezias, 1990) have argued that developing new technologies requires specific activities such as searching for new landscapes, risk taking and experimentation. Given the need of such explorative activities, the question arises to what extent formal governance mechanisms are appropriate means to manage inter-organizational collaboration that aims to develop new technologies. The reliance on formal control and formal coordination seems to contradict the nature of the activities needed for innovation. In this paper, it is our aim to develop insights about this conflictual tension between formal governance structures on the one hand and the creation of a relational field in which explorative activities can be conducted on the other hand. Through confronting the literature on inter-organizational collaboration and the literature on innovation, we will identify the paradoxical requirements that have been formulated with regard to governing inter-organizational collaboration used to develop new technologies.

While the theoretical perspectives of TCE and OT versus those of innovation seem to formulate contradictory advice of how to manage explorative R&D collaboration, empirical evidence of successful inter-organizational collaboration, applied to develop new technologies, is present. Studying the start-ups' performance in Canadian biotechnology, Baum, Calabrese, and Silverman (2000) came to the conclusion that alliance networks form a locus of innovation in high-technology fields. Similarly, Shan, Walker, and Kogut (1994) showed that the number of agreements with commercial firms has a positive significant influence on the amount of patents issued by biopharmaceutical start-ups. The cross-sectional research of Tether (2002) indicated that organizations, who were between 1994 and 1996

engaged in at least one innovative oriented inter-organizational collaboration project, had a significantly higher probability of introducing within this same period at least one innovation that was new to the market –signaling the presence of new technologies-, than organizations who did not collaborate at all during this period. Although these studies indicate the possibility of inter-organizational collaboration to achieve the development of new technologies, they do not provide an answer on how this inter-organizational collaboration can be governed. In specific, it remains unclear how problems of coordination and opportunistic behavior can be addressed without limiting the possibility to conduct explorative activities, needed to develop new technologies. Therefore, the second purpose of this paper is to suggest alternative governance strategies that are able to address problems of opportunistic behavior and coordination without prohibiting the carrying out of explorative activities, necessary to develop new technologies. These alternatives include the avoidance of formalization through collecting second hand information about potential partners as well as the combination of formal and relational governance mechanisms.

Within this paper, we refer to inter-organizational collaboration used to develop new technologies as 'explorative R&D collaboration'. We use the concept of exploration because, as already mentioned, developing new technologies - i.e. developing a technology that incorporates knowledge that is clearly distinctive from the organization's existing knowledge base - requires explorative activities. By referring to R&D collaboration, we want to emphasize that, within this paper, technologically oriented collaborations are considered.

The paper is structured as follows. First, we will explain why, according to TCE and OT, explorative R&D collaboration requires formal governance mechanisms. Second, we will argue that, according to the innovation literature, formal governance mechanisms prohibit the development of new technologies within inter-organizational collaboration. Third, we will suggest alternative solutions that allow for efficient and effective governance of explorative

R&D collaboration. To conclude, we formulate implications of our theoretical arguments for future research and link our theoretical insights to the central conference theme about 'actionable knowledge'.

GOVERNING EXPLORATIVE R&D COLLABORATION: APPLYING A TCE AND OT PERSPECTIVE

Studies on inter-organizational collaboration (e.g. Bleeke & Ernst, 1993; Harrigan, 1988) indicate that success rates of inter-organizational collaboration are low, with estimates suggesting that as many as 60 per cent of all inter-firm collaborations fail. Next to reasons that are external to the collaboration, two reasons, specific to the collaboration itself, are identified to explain this high failure rate. First, according to Transaction Cost researchers, the risk of opportunistic behavior will be high within inter-organizational collaboration. Second, according to Organization Theory researchers, achieving coordinated action will be difficult when independent organizations collaborate. In this section, we will discuss these problems within the setting of explorative R&D collaboration and indicate how, according to TCE and OT, these problems can be minimized.

The Risk of Opportunistic Behavior

According to Williamson (1991: 271), "hybrid modes of contracting are supported by neoclassical contract law". In other words, within inter-organizational collaboration it will be impossible to predict all possible contingencies affecting the collaboration. Therefore, inter-organizational collaboration is characterized by inherently incomplete contracts (Baum et al., 2000; Luo, 2002). The use of incomplete contracts increases the risk of opportunistic behavior, or 'seeking self interest with guile' (Williamson, 1985). Such opportunistic behavior can cause that an organization experiences leakage of proprietary knowledge to partners or losing control of important assets (Hamel, 1991; Williamson, 1991). This kind of

intra-collaboration rivalry retains the potential to severely harm a participating firm. Therefore, when partners experience a high risk of opportunistic behavior, they will be hesitant to fully collaborate with the other partner(s), avoiding that these latter partner(s) can abuse the collaboration for their own private benefit (Das & Teng, 2001; Gulati, Khanna & nohria, 1994; Nooteboom, 1996). In this way, the risk of opportunistic behavior severely limits the successfulness of inter-organizational collaboration.

Not all types of inter-organizational collaboration will be confronted to the same extent with the risk of opportunistic behavior. According to TCE scholars, three categories of exchange hazards, increasing the risk of opportunistic behavior, can be identified within inter-organizational collaboration: 1) asset specificity, 2) measurement problems and 3) uncertainty (Poppo & Zenger, 2002). We expect that the occurrence of these different types of exchange hazards will be very probable within explorative R&D collaboration. First of all, explorative R&D collaboration often requires specific investments of different partners which can not be used for other purposes, increasing asset specificity of the transactions (Lambe & Spekman, 1997). Second, within such innovation projects, performance will often be difficult to measure. After all, potential returns on this kind of investment are often unclear or intangible (Van de Ven & Walker, 1984). Third, conditions of uncertainty are the norm when it comes to developing new technologies (Hill & Rothaermel, 2003). Given the presence of these exchange hazards we can conclude that, following a Transaction Cost Economics (TCE) logic, explorative R&D collaboration faces a substantial risk of opportunistic behavior.

Problems of Achieving Coordinated Action

While researchers, acting from a TCE perspective, focus on problems of opportunistic behavior within inter-organizational collaboration, researchers applying an organization theory perspective (e.g. Doz, 1996; Gulati & Singh, 1998; Ring & Van de Ven, 1994), stress that achieving coordinated action between different partners is difficult. Doz (1996), for

example, illustrates how a strategic alliance between a small entrepreneurial and a large established pharmaceutical organization failed because both partners were using their own organizational routines at the interface between them, often with poorly understood consequences such as conflicts, tensions, and people opting out of the relationship.

According to Gulati and Singh (1998), the task characteristics of the collaboration will determine the extent to which coordination is problematic. In specific, following Thompson (1967), they argue that the amount of coordination costs is dependent on "the level of interdependence that is necessary for the alliance partners to complete tasks" (Gulati & Singh, 1998: 784). Moreover, taking into account that joint development brings along high levels of task interdependence, Gulati and Singh (1998) propose that collaborations with a substantial technological component experience high coordination costs. In this way, we can expect that coordination within explorative R&D collaboration will be problematic.

Formal Governance Mechanisms to Address Problems of Opportunistic Behavior and Coordination

The literature on inter-organizational collaboration not only has identified problems threatening efficient and effective inter-organizational collaboration, it also has provided solutions to deal with these problems. In specific, researchers, both from a TCE and OT perspective, have stated that formal governance mechanisms should be implemented to reduce as well the risk of opportunistic behavior as problems of coordination. We first clarify the meaning of formal governance mechanisms and then argue why, according to TCE and OT, implementing a formal governance structure minimizes risks of opportunistic behavior and problems of coordination.

Formal governance mechanisms. Governance mechanisms are "structural arrangements deployed to determine and influence what organizational members do" (Fryxell, Dooley & Vryza, 2002: 868). According to Dekker (2003), formal governance mechanisms

consist of 1) contractual obligations and 2) formal organizational mechanisms. Contractual obligations represent promises or obligations to perform particular actions in the future (Macneil, 1978). The more contractual obligations codified within the formal contract, the greater is the specification of promises, obligations, and processes for dispute resolution (Poppo & Zenger, 2002). Gulati and Singh (1998), on the other hand, identified five important types of organizational or hierarchical control mechanisms that are frequently used in inter-organizational collaborations: 1) command structures and authority systems, 2) incentive systems, 3) standard operating procedures, 4) dispute resolution procedures, and 5) non-market pricing-systems[1]. The more formal organizational mechanisms are present, the greater is the reliance on formal social-psychological processes during the collaboration (Ring & Van de Ven, 1994)

The advantages of formal governance mechanisms. Both TCE and OT argue that implementing formal governance mechanisms will have a positive influence on the efficiency and effectiveness of inter-organizational collaboration. First of all, implementing formal governance mechanisms triggers formal control processes (Fryxell et al., 2002). Formal control emphasizes the establishment and utilization of formal rules, procedures, and policies to monitor and reward desirable performance (Das & Teng, 2001). According to TCE scholars (e.g. Oxley, 1997; Pisano, 1990; Willimason, 1985), formal control makes it possible to deal with problems of opportunistic behavior. In specific, formal control allows aligning incentives of the different partners and provides monitoring of behavior and/or outcomes of the collaboration (Williamson, 1975, 1985). In this way, formal control may help to 1) ensure that partners make efficient ex ante investments and 2) reduce ex post bargaining and hold up threats. Therefore, following TCE, we can expect that implementation of formal governance mechanisms significantly reduces the risk of opportunistic behavior within inter-organizational relationships (Deeds & Hill, 1998).

While TCE researchers focus on the control function of formal governance mechanisms, researchers, looking from an OT perspective (e.g. Dekker, 2003; Gulati & Singh, 1998), have stressed that these mechanisms also facilitate coordination between partners. By clearly stipulating the obligations and responsibilities of the different partners within the formal contract, tasks of partners, relationships between partners and boundaries on decisions and activities are extensively specified (Klein Woolthuis, Hildebrand & Nooteboom, 2002). Moreover, formal organizational mechanisms such as standard operating procedures, command structures, and authority systems typically include planning, rules, procedures, and programs (Gulati & Singh, 1998). According to Pondy (1977), all of these serve the common purpose of minimizing communication, simplifying decision making, reducing uncertainty about future tasks, and preventing disputes. In other words, formalized coordination (i.e. coordination that relies on formal control mechanisms) "makes the division of labor and the interactions between partners more predictable and allows joint decisions to be made more by rules than by exception" (Gulati & Singh, 1998: 786). In this way, ongoing task coordination will be facilitated (Galbraith, 1977; March & Simon, 1958).

In conclusion, implementing formal governance mechanisms allows dealing with both problems of coordination and risks of opportunistic behavior within inter-organizational collaboration. Therefore, following both TCE and OT, we propose:

> Proposition 1: Formal governance mechanisms reduce the risk of opportunistic behavior and coordination within explorative R&D collaboration.

GOVERNING EXPLORATIVE R&D COLLABORATION: AN INNOVATION PERSPECTIVE

Explorative R&D collaboration, bringing together R&D people from different organizations to search for new technological trajectories, has been recognized as a powerful tool to

accelerate the development of new technologies (Doz & Hamel, 1997; Doz & Williamson, 2002; Wheelwright & Clark, 1992). The advantages of using inter-organizational collaboration to develop new technologies are multiple. First of all, inter-organizational collaboration allows spreading the costs of R&D activities over different partners (Hagedoorn, 1993; Harrigan, 1986; Veugelers, 1998). In this way, the economic risks of developing new technologies are reduced for each organization, stimulating organizations to engage in such innovation projects. Second, R&D collaboration allows for the transfer of knowledge, facilitating cross-fertilization (Doz & Williamson, 2002). Moreover, because of the close interaction during inter-organizational collaboration, not only the knowledge itself, but also the competencies in which this knowledge is embedded can be shared (Roberts & Berry, 1985). In this way, inter-organizational collaboration seems to be the appropriate tool to assemble a large pool of different but complementary knowledge.

However, developing new technologies is not a straightforward task. In this section, based on the innovation literature, we will argue that developing new technologies requires specific activities such as searching for new landscapes, risk taking and experimentation. Next, we will illustrate that, to conduct these activities, a specific relational field has to be present characterized by heterogeneity, task conflict, and redefining existing identities. Finally, we will assess whether formal governance mechanisms, implemented to reduce the risk of opportunistic behavior and problems of coordination, also support a relational field in which explorative activities can be conducted.

The Need for Exploration.

According to the innovation literature (e.g. Ahuja & Lampert; 2001; Burgelman, 1983; Lant & Mezias, 1990), developing new technologies requires activities such as searching for new landscapes, taking risks and conducting experiments. Organizational learning theorists (e.g. Holmqvist, 2003; Levinthal & March, 1993; March, 1991) have referred to these activities as

activities of exploration. Conducting exploration provides the organization with multiple benefits from the perspective of developing new technologies. First of all, exploration can increase an organization's problem-solving arsenal (Amabile, 1988). These alternative problem-solving strategies can bring along new insights in how emerging problems can be tackled, stimulating the development of new technologies. Second, explorative activities such as experimentation have been recognized as the only viable way to generate information with regard to problems, characterized by the absence of a cause-and-effect understanding (McGrath, 2001; Makhija & Ganesh, 1997). Because developing new technologies will often bring along such problems, exploration seems to be necessary. Finally, exploration will allow challenging the cognitive structures and cause-effect relationships that characterize the established technologies of the organization (Ahuja & Lampert, 2001). In this way, new insights can emerge, leading to the development of new technologies.

These explorative activities have to be clearly distinguished from exploitative activities such as refinement, standardization and systematic cost reduction (Koza & Lewin, 1998; March, 1991). Exploitation can bring along a sufficient amount of selection, needed to optimize existing technologies, but can not create enough variation, necessary to cause the development of new technologies (McGrath, 2001; Holmqvist, 2003).

How to Conduct Exploration?

We just illustrated why developing new technologies requires exploration[2]. According to Van Looy, Debackere and Bouwen (2003), conducting exploration asks for a specific relational field in which heterogeneity is present, task conflict is allowed, and redefining existing identities is possible. We will now discuss this specific relational field more detailed.

Heterogeneity has to be present. Schön (1963) argued that novel solutions and insights stem from problem-defining and problem-solving interaction sequences, whereby multiple opinions and viewpoints become integrated into a new synthesis or artifact.

Similarly, Pelz and Andrews (1966), came to the conclusion that differences between the scientist and his/her colleagues in their technical strategy or approach to work may provide the intellectual jostling or 'dither' which is needed for really creative work. More recently, Argyres (1996) illustrated that strategies aimed at broadening (and exploring) technological capabilities require intensive inter-divisional collaboration. In this way, conducting activities such as searching for new landscapes and experimentation seems to imply generating and addressing differences in opinion and interpretation between the actors involved (Van Looy et al., 2003). In other words, heterogeneity of skills, knowledge and attitudes has to be present when teams have to carry out explorative activities.

Task conflict has to be allowed. The presence of heterogeneity between team members is a necessary, but not a sufficient condition to conduct explorative activities. Kuhn (1962) already came to conclusion that, when different communities of practice are confronted with each other, conflict will emerge. Therefore, Van Looy et al. (2003) argue that conflict and tensions are inherent dimensions of exploration.

According to the conflict literature (Guetzkow & Gyr, 1954; Jehn, 1995; Priem & Price, 1991), a distinction has to be made between task and relationship conflict. Task conflict exists when there are disagreements among group members about the content of the tasks being performed, including differences in viewpoints, ideas, and opinions. Relationship conflict exists when there are interpersonal incompatibilities among group members, which typically includes tension, animosity, and annoyance among members within a group (Jehn, 1995: 258). While relationship conflict has been identified as detrimental for all kind of groups (Jehn, 1995; Pelled, 1995), task related conflicts seems to be beneficial for groups that have to conduct non-routine tasks such as explorative activities. After all, task related conflict brings along critical evaluation, increasing thoughtful consideration of alternative solutions, and encourages people to develop new ideas and approaches (Baron, 1991; Janis, 1982; Jehn,

1995; Simons & Peterson, 2000). Moreover, group pressure toward agreement, leaving little room for task conflict, "can squelch the creativity needed to complete non-routine tasks effectively, because members will focus on building consensus rather then entertaining innovative ideas" (Jehn, 1995: 260). Therefore, when exploration is needed, task conflict should be allowed to occur (Van Looy et al, 2003).

De Visch, Wyns, Bruyn, and Bouwen (1988), by studying different innovation projects, have come up with two dialogue-strategies that allow handling task related conflicts within heterogeneous innovation teams without causing the escalation of relational conflict: 1) the 'musical chairs' strategy and 2) the merry-go-round strategy. Within the musical chairs strategy, the team shifts from one perspective to the other, by sequentially giving the floor to the different parties. In this way, all parties will be confronted in a systematic way with the different perspectives. In the merry-go-round strategy, on the other hand, parties are first stimulated to address different perspectives at the same time. Next, parties are asked to reframe their own perspective, taken into account the perspectives of the other parties.

Redefining existing identities has to be possible. Such dialogue-strategies, however, can only be successful when individuals are able/willing to question their own identity. According to the seminal work of Argyris and Schön (1978), most of the time, organizational members are programmed to "respond to changes in the internal and external environments of the organization by detecting errors which they then correct so as to maintain the central features of organizational theory-in-use" (Argyris & Schön, 1978: 18). Moreover, such a single-loop learning system, in which existing identities are continuously confirmed, programs people "to resist exploring issues that might surface threatening information and arouse feelings" (Argyris & Schön, 1978: 198). Therefore, Argyris and Schön (1978: 29) believe that changing existing theory–in-use requires double-loop learning in which "response to detected error takes the form of joint inquiry into organizational norms themselves, so as to

resolve their inconsistency and make the new norms more effectively realizable". More recently, Brown and Duguid (1991) propose that 'enacting organizations'[3] must be capable of reconceiving not only its environment but also its own identity. Given these propositions, it is not surprising that Van Looy et al. (2003) stress that conducting explorative activities asks for a relational field in which existing identities can be questioned.

Based on these arguments, we can conclude that exploration indeed asks for a relational field characterized by heterogeneity, task conflict, and redefining existing identities. We have to remark that, according to Van Looy et al. (2003), such a relational field will be detrimental for activities of a more exploitative nature. In these circumstances, a relational field characterized by homogeneity, consensus, and confirming existing identities will be necessary. Therefore, following an innovation perspective, we propose:

> Proposition 2: A relational field characterized by heterogeneity, task conflict, and redefining exisitng identities facilitates explorative activities, needed to develop new technologies within explorative R&D collaboration.

Do Formal Governance Mechanisms Facilitate Exploration?

As already mentioned, formal governance mechanisms reduce the risk of opportunistic behavior and problems of coordination within inter-organizational collaboration. However, the question arises whether formal governance mechanisms also facilitate the development of new technologies? In other words, are formal governance mechanisms able to facilitate the carrying out of explorative activities? We will address this question from the perspective of the innovation literature.

Implementing formal governance mechanisms allows for formal control and formalized coordination. Brown (1983), however, argues that relying on over-organized interfaces (i.e. interfaces between partners characterized by clear goals and by well-defined

and enforced rules and procedures) limits the possibilities for innovation. Similarly, a large amount of innovation researchers (e.g. Burns & Stalker, 1961; Damanpour, 1991; Pierce & Delbecq, 1977) have come to the conclusion that formalization prevents innovative solutions. The findings of McGrath's (2001) study of 56 new business development projects that innovation projects characterized by formal role and job definitions were less effective than innovation projects in which role and job definitions were less formalized are therefore not surprising.

Explanations, indicating why formalization limits exploration, are also numerous. According to 'The Simplified Merton Model' of March and Simon (1958: 41), reliance on formalized role behavior brings along rigidity of behavior. Stressing formal roles and job definitions discourages people to deviate from the expected behavior, making the occurrence of creativity very unlikely. Similarly, Kiesler and Sproull (1982) propose that explicit rules, procedures and programs narrow the field of search, create a frame for the interpretation of new information and increase the likelihood that data disconfirming the decision premises upon which the objectives were based will be ignored. More recently, Benner and Tushman (2003) illustrated that formalized process management practices such as ISO 9000 and Six Sigma push an organization for productivity leaving little room or slack for experimenting or pursuing novel ideas and concepts. In these circumstances, engineers and scientists become anxious to conduct exploration because, compared to returns from exploitation, returns from exploration are systematically less certain, more remote in time, and organizationally more distant from the locus of action (Katz & Allen, 1985; March, 1991). To conclude, formal governance mechanisms support a relational field characterized by homogeneity, avoiding task conflict, and confirming existing identities. As already mentioned, such a relational field can facilitate exploitation, but will prohibit exploration. Hence:

Proposition 3: Formal governance mechanisms prohibit the carrying out of explorative activities within explorative R&D collaboration.

HOW TO GOVERN EXPLORATIVE R&D: ALTERNATIVE SOLUTIONS

Several studies (e.g. Baum et al., 2000; Couchman & Fulop, 2001; Shan et al., 1994; Tether, 2002) provide evidence of successful explorative R&D collaboration. However, these studies do not provide an answer on how explorative R&D collaboration has to be governed. Moreover, as argued in the previous sections, looking at different theoretical perspectives, paradoxical requirements are being formulated. While TCE and OT emphasize the use of formal governance mechanisms to deal with risks of opportunistic behavior and problems of coordination, the innovation literature argues that formal governance mechanisms will prohibit the carrying out of explorative activities, necessary to develop new technologies. Therefore, the question arises of how to govern in such a way that explorative activities can be conducted while at the same time the risk of opportunistic behavior and coordination costs are being reduced. In this section, we suggest alternative solutions to achieve efficient and effective governance of explorative R&D collaboration. First, applying a structural sociological perspective, we discuss the alternative of collaborating with familiar partners. Next, we suggest two other alternatives that, in our opinion, can facilitate effective and efficient governance of explorative R&D collaboration: 1) collecting second hand information about potential partners and 2) combining formal and relational governance.

Collaborating with Familiar Partners.

A first alternative is to set up a R&D collaboration with familiar partners. Until now, we implicitly assumed that partners did not have a history of prior interaction when the collaboration takes of. However, researchers, applying a structural sociological perspective (e.g. Ahuja, 2000; Eisenhardt & Schoonhoven, 1996; Granovetter, 1985; Gulati, 1995), have

stressed that organizations, which have a history of prior interaction, are likely to collaborate again in the future. Moreover, when partners collaborated in the past, they do not feel the need to extensively formalize the collaboration. Gulati and Singh (1998), for example, showed that, when prior ties were present, non-equity arrangements were chosen instead of equity arrangements, representing the absence of hierarchical control mechanisms. Similarly, Kogut, Shan, and Walker (1993) argue that when prior collaboration is present, the need for well-specified contracts will be much less present. We now consider more in-depth this alternative strategy. First we clarify why collaboration with familiar partners as well reduces the need for formal governance as increases the possibility to rely on relational governance. Next, we argue that relational governance facilitates explorative activities. Finally, we identify possible problems of collaborating with familiar partners with respect to developing new technologies.

Collaboration with familiar partners reduces need for formalization. Collaborating with familiar partners will reduce the need for formalization for two reasons. First of all, when partners have collaborated successfully in the past, trust or "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (Rousseau, Sitkin, Burt & Camerer, 1998: 395) will be build up between the partners[4]. In specific, repeated cycles of exchange, risk taking, and successful fulfillment of expectations will provide firsthand information about the extent to which the other partner is indeed trustworthy, leading to competence-based trust (Das & Teng, 2001; McAllister, 1995; Rousseau et al., 1998). Moreover, next to providing firsthand knowledge about the partner's competences and intentions, repeated interactions can give rise to the emergence of a shared psychological identity, indicating the presence of shared norms, values and beliefs (Gaertner, Dovidio & Bachman, 1996). According to researchers such as Parssons (1951) and Fukuyama (1995) positive expectations will arise when people share the

same values or norms. This type of trust, based on the development of a mutual understanding, has been called goodwill trust (Das & Teng, 2001; McAllister, 1995; Ring & Van de Ven, 1994). When, because of prior interactions, competence and goodwill trust are present, the perceived risk of opportunistic behavior will be limited (Das & Teng, 2001; Nooteboom, 1996). Therefore, implementing formal governance mechanisms to reduce the risk of opportunistic behavior will not be necessary.

Second, because of the social structure of prior interactions, firms may have developed routines together to enable ease in joint interaction with each other (Gulati & Singh, 1998; Ring & Van de Ven, 1994). In other words, prior interaction brings along the creation of inter-organizational routines, facilitating coordination between the partners (Dyer & Singh, 1998). In this way, the occurrence of coordination problems will be less likely, reducing the need to implement formal governance mechanisms (Dekker, 2003; Gulati & Singh, 1998).

Collaboration with familiar partners stimulates relational governance. The presence of trust and inter-organizational routines does not only reduce the need for formal governance mechanisms, but it also allows for an alternative way to govern the relationship between familiar partners. In specific, governance can emerge from the shared norms and values and agreed-upon processes embedded within such long-lasting social relationships (Deeds & Hill, 1998; Poppo & Zenger, 2002). Within such 'relationally-governed' relationships, processes of control and coordination will differ from the formal control and coordination processes that characterize formally-governed inter-organizational relationships.

When exchanges are relationally-governed, divergence between different partners can be minimized by referring to the shared norms, values and routines present, instead of emphasizing rules, procedures and policies (Eisenhardt, 1985, Ouchi, 1979). In other words, social control will substitute for formal control.

Moreover, relational governance brings along norms of flexibility, solidarity, and information exchange (Poppo & Zenger, 2002). In this way, issues of coordination can be addressed, not by referring to formalized rules and procedures, but by the simple process of real-time, informal communication. In this way coordination by mutual adjustment will replace formalized coordination. (Mintzberg, 1979; Poppo & Zenger, 2002; Thompson, 1967).

Relational governance facilitates exploration. The substitution of formal control and coordination by social control and coordination by mutual adjustment seems to be promising with respect to carrying out explorative activities. According to Ouchi (1980: 134), social control allows carrying out tasks that are "highly unique, completely integrated, or ambiguous for other reasons". After all, compared to bureaucratic (i.e. formalized) structures, in which surveillance, evaluation and direction are stressed, organizational structures characterized by social control, in which shared norms, values and routines are emphasized, much less restrict behavior of individuals[5].

Also the substitution of formalized coordination by coordination by mutual adjustment is beneficial with respect to carrying out explorative activities. According to the innovation literature, coordination by mutual adjustment, characterized by excessive information sharing and informal communication, stimulates innovative solutions (Damanpour, 1991). In specific, excessive information exchange between communities-of-practice has been brought forward as an essential condition for innovation (Bouwen, De Visch & Steyaert, 1992; Brown & Duguid, 1991; Brown & Eisenhardt, 1995; Cohen & Levinthal, 1990). Excessive information exchange will make heterogeneity in skills, knowledge and attitudes between members of different partners explicit. In this way, cross-fertilization of ideas becomes possible, stimulating creativity and questioning existing identities (Aiken & Hage, 1971; Weick & Roberts, 1992). Moreover, by relying on informal communication, differences of opinions can

be addressed openly (Deeds & Hill, 1998; Dougherty, 1992, Pierce & Delbecq, 1977). This allows handling task conflict without risking an escalation of relationship conflict. In this way, compared to formal governance, relation governance, stimulating social control and coordination by mutual adjustment, seems to support the carrying out of explorative activities.

Problems of collaborating with familiar partners. Despite the advantages of collaborating with familiar partners, this may not be a viable alternative for explorative R&D collaboration. The main reason is that dense social times may restrict firms from new information and new opportunities (Gargiulo & Benassi, 2000; Rowley et al., 2000; Uzzi, 1997). Organizations who collaborate repeatedly with each other, build up a large amount of domain similarity (i.e. organizations have the same services, clients, and personnel skills; Van de Ven & Walker, 1984: 601). In this way, firms, entering multiple collaborations over time with each other, will be confronted with "diminishing marginal increments of information" (Gulati, 1995: 626). In other words, collaborating in the past reduces the amount of heterogeneity present between the partners. However, when the objective of the collaboration is to develop new technologies through conducting explorative activities, heterogeneity is necessary. Hence:

> Proposition 4: Collaborating with familiar partners, although it facilitates relational governance, is not a viable option with respect explorative R&D collaboration because heterogeneity between the partners will be limited.

Collecting Second Hand Information about Potential Partners.

A second alternative strategy is to collect second hand information about potential partners. This strategy is formulated following trust researchers, (e.g. Barber, 1983; McKnight, Cummings & Chervany, 1998) who argue that credible secondhand information regarding the intentions or competence of potential partners can bring along positive expectations, leading

to trust. Such credible information about the trustee may be provided by others (e.g. reputation) or by certification (e.g. a diploma) (Rousseau et al., 1998). These "proof sources" signal that the trustee's claims of trustworthiness are true'. Meyerson, Weick, and Kramer (1996) have referred to this type of trust, which relies on the reputation of the other involved people and on category-driven information-processing such as unit grouping and stereotyping, as 'swift trust'. Moreover, they stated that, within temporary systems, such trust is a useful alternative for formal governance mechanisms to reduce the perceived risk of opportunistic behavior.

We also expect that, when, by collecting reliable secondhand information, a competent partner can be chosen, coordination problems are reduced. After all, it seems probable that working with a competent partner on complex and uncertain tasks requires less coordination to achieve similar results as compared to when working with a less competent partner (Dekker, 2003).

Therefore, we argue that collecting secondhand information about potential partners reduces problems of opportunistic behavior and coordination, making formal governance mechanisms redundant. In this way, from the beginning of the collaboration, partners can aim for relational governance by relying on relational governance mechanisms instead of formal governance mechanisms. Das and Teng (2001) identified two relational governance mechanisms that can be used within inter-organizational collaboration: 1) participatory decision-making and 2) cultural activities such as rituals, ceremonies, and networking[6]. These relational governance mechanisms foster processes of socialization and joint sensemaking (Ring & Van de Ven, 1994). The occurrence of these social-psychological processes makes the achievement of shared values, beliefs and routines more likely (Fryxell et al., 2002). In this way, collaboration can rely on relational governance instead of formal governance.

To conclude, collecting second hand information about potential partners reduces the need for formalization by building up swift trust and increasing the probability of finding a competent partner. In this way, relational governance mechanisms can be stressed within the collaboration, stimulating the creation of shared norms, values and beliefs. As mentioned before, relational governance, by triggering processes of social control and coordination by mutual adjustment, stimulates the carrying out of explorative activities. Moreover, opposite to the option of collaborating with familiar partners, collecting secondhand information does not reduce heterogeneity between the partners. Therefore, we propose:

> Proposition 5: Collecting second hand information about potential partners, by stimulating relational governance without reducing heterogeneity between the partners, allows for effective and efficient governance of explorative R&D collaboration.

Combining Formal and Relational Governance.

A third and final strategy of governing explorative R&D collaboration is to combine formal and relational governance. Until now we have argued that relational governance becomes possible when the need for formal governance is reduced. This corresponds to a vast amount of literature in which formal and relational governance are seen as substitutes (e.g. Arrow, 1974; Gulati, 1995; Larson, 1992; Macaulay, 1963; Malhorta & Murnighan, 2002). First, according to these researchers, relational governance lowers transaction costs and facilitates adaptive responses, making formal governance obsolete. Larson (1992), for example, found out that, when informal social controls were present, formal controls were pushed to the background. Second, these researchers argue that, when formal governance is emphasized, the formation of relational governance will be undermined. By conducting experiments, Malhorta and Murnighan (2002) provided evidence that, when formal contracts are present,

individuals are not able to make personal attributions to the collaboration, limiting the development of interpersonal trust. Similarly, Macaulay (1963: 64) argued that the presence of carefully planned contracts 'indicates a lack of trust and blunts the demands of friendship, turning a cooperative venture into an antagonistic horse trade'.

However, Poppo and Zenger (2002) found evidence, indicating that formal and relational governance mechanisms can be complements instead of substitutes. In specific, they found out that 1) contract complexity, indicating the presence of formal governance, increases relational governance, which in turn increases exchange performance and 2) greater relational governance appears to positively affect contractual complexity, which in turn increases exchange performance. These findings support the argument of Macneil (1978) that relational governance becomes a necessary complement to the adaptive limits of formal contracts by fostering continuance and bilateralism when change and conflict arise. Moreover, these results indicate that contracts, that shift from merely specifying deliverable outcomes to providing frameworks for bilateral adjustments may facilitate the evolution of highly cooperative exchange relations (Klein Woolthuis et al., 2002; Poppo & Zenger, 2002).

The idea that formal and relational governance can be complements instead of substitutes is also reflected in the seminal paper of Ring and Van de Ven (1994). In this paper, Ring and Van de Ven (1994: 112) argue that "cooperative inter-organizational relationships are maintained, because they create balance: balance between formal and informal processes." This quote indicates that, combining formal and relational governance, instead of choosing between these two options, seems to be a promising alternative to govern inter-organizational relationships. However, Ring and Van de Ven (1994) did not really provide guidelines to achieve and maintain such a combination. We will here suggest how formal and relational governance can be combined and argue that such a combination is particularly of interest to explorative R&D collaboration.

Couchman and Fulop (2001) studied the successful collaboration between two public research agencies and one private company, bringing along the development of a new technology, allowing for the development of a commercially-viable contact lens which could be worn continuously for a period of up to one month. From the beginning, the task and relational characteristics of this collaboration were extensively formalized. Couchman and Fulop (2001: 22) themselves talk about a 'disciplined approach' with regard to the organization and management of the project. In specific, the existence of a contract book - a document which defined in detail the project goals and the plan of action to achieve these goals – were mentioned as one of the major factors, guaranteeing that the collaboration project was "put on a sound footing" (Couchman & Fulop, 2001: 22). However, at the same time, a secure computer network was installed, weekly teleconference meetings were held among the different teams, and 6-monthly face-to-face project review meetings were held. According to Couchman and Fulop (2001: 25), these three communication media "contributed to the intensity of communication and to overall team-building, and helped to maintain the project energy."

Similarly, Brown and Eisenhardt (1997: 28), by studying the computer industry, showed that some organizations applied semi-structures, "in which some features are prescribed or determined (e.g. responsibilities, project priorities, time intervals between projects), but other aspects are not (e.g. design process, communication)". Moreover, they came to the conclusion that organizations, which applied semi-structures, representing a balance between mechanistic and organic organizational structures, were the most performant in terms of innovation.

These findings suggest that combinations of formal and relational governance seem to be possible. Moreover, taken into account the specific innovative context in which these

studies were conducted, these solutions seem to be particularly valuable within innovative settings where exploration is needed. Hence:

Proposition 5: Combining formal and relational governance allows for effective and efficient governance of explorative R&D collaboration.

CONCLUSION

Inter-organizational collaboration is an important alternative for the internal development of new technologies. However, governing explorative R&D collaboration seems to be problematic. While TCE and OT emphasize the need for formal governance mechanisms to reduce the risks of opportunistic behavior and problems of coordination within explorative R&D collaboration, the innovation literature stresses that formal governance mechanisms prohibit the carrying out of explorative activities which are necessary to develop new technologies. Given this paradoxical situation we have suggested two alternative solutions to achieve effective and efficient governance within explorative R&D: collecting second hand information about potential partners and combining formal and relational governance mechanisms. Empirical validation of these two strategies, however, is limited. It remains unclear, for instance, what type of coordination and control will be triggered when formal and relational governance mechanisms are combined. Moreover, research that has considered some of these alternatives sometimes comes to surprising conclusions. Dekker (2003), for example, by studying 817 transactions between buyers and suppliers of information technology products and services, found out that intensive partner selection efforts (i.e. efforts to build up second-hand knowledge based trust) brought along more instead of less formalization. Therefore, further research assessing these alternative solutions within the context of inter-organizational collaboration seems to be necessary.

Suggestions for Further Research

In our opinion, two limitations of existing research, focusing on governance of inter-organizational collaboration, have to be overcome. First of all, within existing research, governance structures are most of the time considered to be a static phenomenon. However, Reuer, Zollo, and Singh (2002), studying collaborations in the biotechnology industry, found that forty percent of the collaborations examined changed their initial governance structure. Moreover, Ring and Van de Ven (1994) propose that it could be beneficial within inter-organizational relationships to change the governance structure during the collaboration. In specific, they propose that, during the initial stages of the collaboration, collaboration should rely on formal governance. Later on, relational governance should gradually be introduced to avoid over-formalization. Similarly, Fryxell et al. (2002) provided evidence that new joint ventures, which apply formal governance mechanisms, perform better than new joint ventures, which do not formalize extensively in the beginning. At the same time, they found out that older joint ventures, which are relationally-governed, perform better than older joint ventures which rely on formal governance. These results indicate that looking at the dynamics of inter-organizational governance is an important issue. In other words, we do not have to answer 'What governance mechanisms have to be implemented?', but rather have to assess 'When should we implement which governance mechanisms?'. Longitudinal or retrospective research seems to be necessary in this respect.

In this research domain, people have focused on the management level of the collaboration. Alliance managers, who are responsible for the strategic and tactical aspects of the collaboration, have been used as key informants for studies examining inter-organizational collaboration (Currall & Inkpen, 2000). The team members, entrusted with the operational activities of the collaboration, have been much less involved in this kind of research (Oliver & Roos, 2002). We assume that, especially within explorative R&D collaborations, these

operational team members (i.e. R&D personnel of the different partners) will determine to a large extent the successfulness of the collaboration. After all, these people will have to conduct the explorative activities, necessary to bring along new technologies. Therefore, we argue that, when we want to understand the conditions for successful inter-organizational collaboration, which aims for developing new technologies, it is important to assess both management and operational levels.

Epilogue: Implications for Creating Actionable Knowledge

This paper on explorative R&D collaboration might bear specific relevance to the conference theme 'actionable knowledge'. While the knowledge gap between scholars and practitioners has been a continuous concern of the Academy of Management, the theme of this year reflects the growing awareness for this lasting challenge. Bridging different types of knowledge is a way to frame the issue of creating actionable knowledge. Bridging knowledge might even be considered as a condition sine qua non to arrive at actionable – i.e. implemented - knowledge. Inter-organizational collaboration within the context of innovation can be considered as a specific, highly informative, case in this respect (see special issue on 'Bridging the Relevance Gap' in British Journal of Management, 2001). Inter-organizational collaboration indeed concerns collaboration between heterogeneous actors facing the challenge of creating novel approaches that work. Our preliminary conclusions suggest the importance of a creative combination of formal as well as relational governance practices on different levels in order for this heterogeneity or diversity to result in actionable terms. Brown & Duguid (1991) stressed the importance of communities of practice for intra-organizational innovation projects. They also favor a knowledge-as-participation metaphor instead of a knowledge-as-substance metaphor to understand how researchers and technicians exchange findings and develop new ideas in informal dialogues around specific technical problems. The challenge for inter-organizational collaboration, between industrial partners as well as between

academic and industrial partners, can probably better be understood by looking into the characteristics of the governance practices to span or bridge knowledge communities. By engaging in common practices actors can enact the formal and relational governance activities that allow the bridging of the knowledge gaps present. Getting a deeper insight in how to develop such governance activities effectively, pertains directly to how we conceive knowledge; not only as an asset that can be traded but also as a common practice that can be enacted. In our further research we will focus on moments of interfacing that allow successful collaborations to translate into concrete, actionable, results.

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ENDNOTES

1. These formal organizational mechanisms also can be codified within the inter-organizational contract. In this way, formal organizational mechanisms also become contractual obligations, increasing the specificity of the contract.

2. In this paper we stress that developing new technologies requires exploration. However, sometimes also exploitative activities are needed within such innovation projects. Moreover, we acknowledge that also within innovation projects, aiming for the optimization of existing technologies, exploration can be necessary. Nevertheless, following the innovation literature, we assume that the amount of exploration will be significantly higher within innovation projects, aiming for the development of new technologies than within innovation projects that focus on improving existing technologies. Exploitation, on the other hand, will be predominant within the latter type of innovation projects.

3. Brown and Duguid (1991: 179) define the enacting organization as "proactive and highly interpretive. Not only does it respond to its environment, but also, in a fundamental way, it creates many of the conditions to which it must respond." In this way, exploration will be of main importance within such organizations.

4. Although, according to the definition of Rousseau et al. (1998), trust ultimately reside with individuals, a large amount of researchers (e.g. Currell & Inkpen, 2000; Gulati & Singh, 1998; Tomkins, 2001; Zaheer et al., 2002) have argued that the concept of trust is also applicable on an inter-firm level.

5. However, when social control becomes so strong that existing norms, values and routines can not be questioned any more, conducting explorative activities will also become problematic. After all, the more these shared norms and values are stressed, the more difficult it will be for individuals to deviate from these shared norms and values (Christensen & Overdorf, 2000; Van Looy et al., 2003). In these circumstances, reframing existing identities

will become extremely difficult, prohibiting exploration. Nevertheless, following researchers such as Katz and Allen (1982), March (1991) and Nooteboom (1996), the occurrence of exaggerated social control can be avoided by maintaining a moderate amount of employee turnover within the collaborative team.

6. A large amount of researchers (e.g. Arrow, 1974; Dyer & Singh, 1998; Poppo & Zenger, 2002; Ring & Van de Ven, 1992) also have identified trust as a social control mechanisms. However, following researchers such as Currall and Inkpen (2000), Das and Teng (1998) and Rousseau et al. (1998) we want to apply a clear distinction between trust (i.e. a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another, Rousseau et al., 1998, p. 395) and control mechanisms (structural arrangements deployed to determine and influence what organizational members do, Fryxell et al., 2002, p.868). In this way, the risk of 'concept stretching' is avoided (Osigweh, 1989).